SOLAR/2036-79/04

Monthly Performance Report

PAGE JACKSON SCHOOL

APRIL 1979

U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

4293

MONTHLY PERFORMANCE REPORT

PAGE JACKSON SCHOOL

APRIL 1979

I. SYSTEM DESCRIPTION

Page Jackson School is an elementary school located in Charles Town, West Virginia. The solar energy system is designed to provide approximately 85 percent of the space heating and 50 percent of the space cooling energy requirements of the school. It has an array of flat-plate collectors with a gross area of 11,000 square feet that faces south at an angle of 45 degrees from the horizontal. Water is used as the medium for delivering solar energy from the collector array to storage. The solar heated water is stored in two interconnected 10,000-gallon storage tanks and is used for space heating and cooling. When the solar energy is insufficient to meet the heating demands, an oil-fired boiler is used to provide auxiliary hot water for heating. In the space cooling mode, the hot water from storage is supplied to an absorption chiller to generate chilled water. A conventional centrifugal chiller is used as backup whenever solar energy is insufficient to meet the space cooling demand.

The system, shown schematically in Figure 1, has three modes of solar operation.

<u>Mode 1 - Collector-to-Storage</u>: The collector subsystem operates independently of the other subsystems. It is active whenever the solar collector temperature is higher than the temperature in storage (hot water thermal storage). When the hot water thermal storage temperature is equal to, or greater than the collector temperature, solar pump P7 is shut down (pump P8 is a backup pump). An emergency mode of operation to prevent overheating of the collectors is manually activated to allow water to continuously circulate through the collectors.

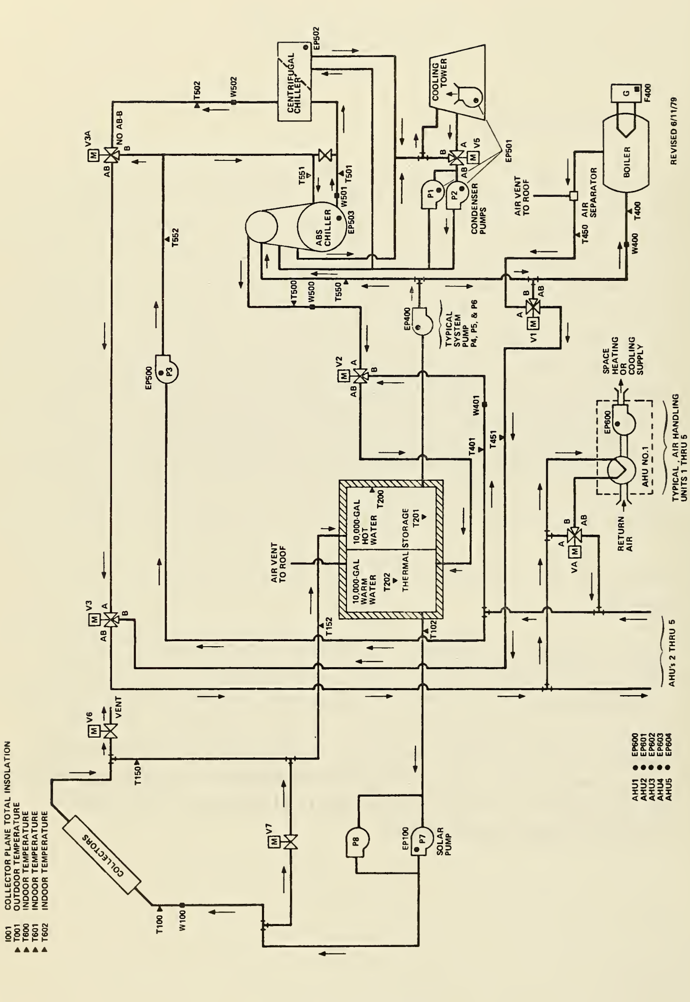

Figure 1. PAGE JACKSON SCHOOL SOLAR ENERGY SYSTEM SCHEMATIC

Mode 2 - Space Heating: This mode is entered when the manual SUMMER-WINTER-AUTOMATIC switch is set to AUTOMATIC and the outside ambient temperature is below 60°F, or when the switch is set to WINTER. Whenever the temperature of the air returning from the air-handling units is below 68°F and the hot water storage temperature is less than 123°F, auxiliary heating is put into the ready condition. The burner for the boiler maintains a boiler water temperature of 160°F. When the hot water drops below 113°F, the boiler is activated, when the storage temperature rises above 113°F, or the return air temperature rises above 68°F, auxiliary heating is shut off.

Mode 3 - Space Cooling: This mode is entered when the manual SUMMER-WINTER-AUTOMATIC switch is set to AUTOMATIC and the outside ambient temperature is above 68°F, or when the switch is set to SUMMER. There are two modes of space cooling; one utilizes the absorption chiller, the other the backup centrifugal chiller. When the hot water thermal storage temperature rises above 180°F, system pumps P4, P5, and P6 are activated to generate flow through the absorption chiller. As the inlet water temperature to the chiller rises above 180°F, the chilled water temperature out of the absorption chiller will become colder. As the temperature from hot water thermal storage drops below 180°F, the reverse will occur. When the hot water thermal storage temperature drops below 171°F, system pumps will stop, and the absorption chiller will no longer be used for space cooling. If there is a demand for space cooling and the storage temperature is below 171°F, the backup centrifugal chiller is used to satisfy the demand.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The solar energy system at Page Jackson School operated continuously during April, and satisfied 66 percent of the space heating energy requirements. There was a small space cooling requirement on two days during April which was completely satisfied by the conventional system.

B. Weather

April is past the peak of the heating season in the Page Jackson School area, with a long-term average outside ambient temperature of 55°F. The actual outside ambient temperature averaged 51°F during April. The measured insolation in the plane of the collector array averaged 1,310 Btu/ft^2-day, which is below the expected long-term average of 1,458 Btu/ft^2-day derived from measurements taken at the Washington, D. C. airport.

C. System Thermal Performance

Collector - Of the 431.93 million Btu of solar energy incident on the collector array during April, 338.11 million Btu were incident on the array when there was flow through the collector array. The system collected 80.38 million Btu, or 19 percent of the total insolation incident on the collector array. The operation of solar pumps P7 and P8 required 2.18 million Btu of electrical energy.

Storage - Of the 82.84 million Btu of energy delivered to storage, 80.57 million Btu were solar energy and 2.27 million Btu were auxiliary energy. This slight energy descrepancy (80.38 versus 80.57 million Btu) between collection and storage is a result of the bridging of four days during the month when data was unavailable. Some of the 2.27 million Btu of auxiliary thermal energy was extracted from storage for space heating, but instrumentation cannot distinguish between solar or auxiliary energy leaving the storage tank.

The daily average storage temperatures ranged from 105°F to 163°F.

Space Heating Load - Space heating energy requirements were the only demand on the solar energy system during April. The space heating load experienced in April was 100.08 million Btu. This is significantly less (approximately 55 percent) than the load experienced in March. Of the 100.08 million Btu, 66.38 were supplied by solar system, and the remainder were from auxiliary thermal energy generated by an oil-fired boiler.

Space Cooling Load - A very small space cooling demand was experienced during two days in April. The total demand was 1.61 million Btu and was completely supported by the conventional (non-solar) system.

D. Observations

The sensor W400, which determines the flow rate through the auxiliary heating system, is located in a line where actual fluid flow can be as low as 30 gallons per minute, or as high as 170 gallons per minute. When the flow is in the lower portion of this range, the calculated value of auxiliary thermal energy used may not be reliable, since a one-bit noise signal from the flowmeter represents 16 gallons per minute. To alleviate this problem, the auxiliary energy input to the system is currently being calculated as 60 percent of the auxiliary fossil fuel consumed. The flowmeter F400 on the oil burner is very accurate and provides a confident value of fuel consumption, and therefore, a reliable measurement of auxiliary energy used.

The exact amount of solar energy used cannot be measured or calculated directly. It is normally computed as the difference between the measured heating load and the sum of auxiliary thermal energy used and auxiliary thermal energy delivered to storage. At the Page Jackson solar energy site, the piping and tanks are well insulated, and, therefore, losses from these components are minimum. Since the boiler efficiency is being estimated at 60 percent, the solar energy used for space heating is an approximate value, but believed to be quite accurate.

At Page Jackson School, an oil-fired boiler is used to supply hot water for space heating whenever there is insufficient solar energy to meet the heating requirements. However, all hot water used for space heating or cooling must flow from storage to the load and back. This can cause auxiliary energy to be transferred from the boiler to storage. The boiler controls are set to maintain water in the boiler between 120°F and 200°F, thus providing conditions which allow water to flow from the boiler to the load and return to storage at a temperature higher than the storage temperature. This can be observed on a number of days in April, but as mentioned in the storage performance subsection of this report, amounts to a small amount of energy.

E. Energy Savings

The Page Jackson School solar energy system resulted in a fossil savings of 110.63 million Btu during the month of April. The operating expense of the solar energy system was 9.46 million Btu of electrical energy, and converting this to fossil energy yields 31.53 million Btu. Therefore, the net fossil savings was 79.10 million Btu. The fossil energy savings calculations are based on a comparison of the projected energy requirements of a conventional, fossil energy boiler, with an efficiency of 60 percent, and the energy requirements of the solar energy system.

III. ACTION STATUS

None.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VIRGINIA   SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

SITE/SYSTEM DESCRIPTION:
THE PAGE JACKSON SOLAR ENERGY SYSTEM PROVIDES SPACE HEATING AND COOLING. THE SYSTEM USES WATER AS A COLLECTION AND STORAGE MEDIUM. HOT WATER FROM THE STORAGE TANK IS DIRECTED EITHER TO IN-DUCT HEATING COILS OR TO THE GENERATOR OF AN ABSORPTION AIR CONDITIONER. A FUEL OIL FIRED BOILER PROVIDES AUXILIARY HOT WATER FOR SPACE HEATING. A CENTRIFUGAL CHILLER PROVIDES ADDITIONAL CHILLED WATER FOR SPACE COOLING.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	431.930	MILLION BTU
	39267	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	80.380	MILLION BTU
	7307	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	51	DEGREES F
AVERAGE BUILDING TEMPERATURE	74	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.15	
ECSS OPERATING ENERGY	2.175	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	40.141	MILLION BTU
TOTAL ENERGY CONSUMED	186.068	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	N.A.	100.077	1.610	101.686	MILLION BTU
SOLAR FRACTION	N.A.	66	0	65	PERCENT
SOLAR ENERGY USED	N.A.	66.376	0.000	66.376	MILLION BTU
OPERATING ENERGY	N.A.	37.501	0.466	40.141	MILLION BTU
AUX. THERMAL ENERGY	N.A.	39.160	0.333	39.492	MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	0.476	0.476	MILLION BTU
AUX. FOSSIL FUEL	N.A.	65.266	N.A.	65.266	MILLION BTU
ELECTRICAL SAVINGS	N.A.	-7.283	0.000	-9.457	MILLION BTU
FOSSIL SAVINGS	N.A.	110.627	N.A.	110.627	MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.507

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978, SOLAR/0004-78/18

4293

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VIRGINIA   SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

SITE/SYSTEM DESCRIPTION:
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GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	455.686	GIGA JOULES
	445910	KJ/SQ.M.
COLLECTED SOLAR ENERGY	84.801	GIGA JOULES
	82981	KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	11	DEGREES C
AVERAGE BUILDING TEMPERATURE	24	DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.15	
ECSS OPERATING ENERGY	2.294	GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	42.349	GIGA JOULES
TOTAL ENERGY CONSUMED	196.302	GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL	
LOAD	N.A.	105.581	1.698	107.279	GIGA JOULES
SOLAR FRACTION	N.A.	66	0	65	PERCENT
SOLAR ENERGY USED	N.A.	70.027	0.000	70.027	GIGA JOULES
OPERATING ENERGY	N.A.	39.563	0.491	42.349	GIGA JOULES
AUX. THERMAL ENG	N.A.	41.313	0.351	41.665	GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	0.502	0.502	GIGA JOULES
AUX. FOSSIL FUEL	N.A.	68.856	N.A.	68.856	GIGA JOULES
ELECTRICAL SAVINGS	N.A.	-7.683	0.000	-9.977	GIGA JOULES
FOSSIL SAVINGS	N.A.	116.712	N.A.	116.712	GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.507

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REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VIRGINIA   SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	8.860	59	1.592	N	0.086	N	0.180
2	2.934	51	2.925	O	0.020	O	0.997
3	2.367	47	1.237	T	0.000	T	0.523
4	0.485	40	0.718		0.000		1.481
5	*	*	*	A	*	A	*
6	38.466	39	8.007	P	0.180	P	0.208
7	24.471	37	5.714	P	0.121	P	0.234
8	13.262	44	4.253	L	0.102	L	0.321
9	1.377	38	1.586	I	0.000	I	1.152
10	23.338	44	3.312	C	0.123	C	0.142
11	*	*	*	A	*	A	*
12	*	*	*	B	*	B	*
13	*	*	*	L	*	L	*
14	17.309	49	1.757	E	0.115	E	0.101
15	12.777	49	3.558		0.115		0.279
16	3.121	45	1.698		0.010		0.544
17	11.776	48	1.692		0.102		0.144
18	26.016	51	2.071		0.131		0.080
19	26.133	53	3.122		0.126		0.119
20	23.522	52	3.444		0.120		0.146
21	24.555	60	2.802		0.123		0.114
22	13.518	64	2.008		0.070		0.149
23	6.829	63	0.994		0.052		0.146
24	5.740	62	1.062		0.074		0.185
25	22.307	69	0.484		0.122		0.022
26	2.073	60	0.000		0.000		0.000
27	7.938	58	0.000		0.010		0.000
28	16.012	51	0.000		0.000		0.000
29	15.437	47	0.000		0.000		0.000
30	23.719	56	3.490		0.082		0.147
SUM	431.930	-	66.376	N.A.	2.175	N.A.	-
AVG	14.398	51	2.213	N.A.	0.072	N.A.	0.154
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VISOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	8.860	8.054	1.653	65	0.187
2	2.934	0.501	0.000	51	0.000
3	2.367	0.000	0.000	47	0.000
4	0.485	0.000	0.000	41	0.000
5	*	*	*	*	*
6	38.466	37.879	9.495	40	0.247
7	24.471	23.465	5.679	*	0.232
8	13.262	12.320	2.763	50	0.208
9	1.377	0.000	0.000	38	0.000
10	23.338	22.660	5.583	*	0.239
11	*	*	*	*	*
12	*	*	*	*	*
13	*	*	*	*	*
14	17.309	16.439	4.342	55	0.251
15	12.777	11.588	1.810	51	0.142
16	3.121	0.621	0.005	48	0.002
17	11.776	8.682	1.408	54	0.120
18	26.016	24.968	6.886	60	0.265
19	26.133	24.814	6.016	60	0.230
20	23.522	22.188	5.525	61	0.235
21	24.555	22.913	5.895	72	0.240
22	13.518	9.990	1.673	71	0.124
23	6.829	3.228	0.018	68	0.003
24	5.740	4.164	0.085	69	0.015
25	22.307	20.966	5.008	77	0.224
26	2.073	0.000	0.000	60	0.000
27	7.938	0.779	0.000	62	0.000
28	16.012	0.000	0.000	67	0.000
29	15.437	0.000	0.000	53	0.000
30	23.719	16.812	5.821	68	0.245
SUM	431.930	338.110	80.380	-	-
AVG	14.398	11.270	2.679	58	0.186
NBSID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
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SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VISOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	1.669	1.592	-0.504	128	0.652
2	0.000	2.925	-3.701	115	1.000
3	1.101	1.237	0.777	106	1.828
4	0.000	0.718	-0.309	109	1.000
5	*	*	*	*	*
6	9.598	8.007	1.219	121	0.961
7	5.711	5.714	1.107	118	1.194
8	2.807	4.253	-1.701	112	0.909
9	0.000	1.586	-0.563	106	1.000
10	5.723	3.312	3.515	121	1.193
11	*	*	1.487	*	*
12	*	*	*	*	*
13	*	*	*	*	*
14	4.381	1.757	2.507	117	0.973
15	1.878	3.558	-2.531	116	0.547
16	0.868	1.698	0.016	105	1.975
17	1.433	1.692	-0.262	108	0.998
18	6.969	2.071	4.982	124	1.012
19	6.209	3.122	2.337	143	0.879
20	5.622	3.444	1.188	153	0.824
21	5.381	2.802	1.791	162	0.854
22	1.709	2.008	-1.417	163	0.346
23	0.019	0.994	-2.314	154	-71.025
24	0.097	1.062	-2.112	139	-10.834
25	5.064	0.484	4.293	146	0.943
26	0.000	0.000	-0.413	159	1.000
27	0.100	0.000	-0.571	156	-5.686
28	0.000	0.000	-0.375	154	1.000
29	0.000	0.000	-0.289	151	1.000
30	5.451	3.490	1.023	152	0.828
SUM	82.835	66.376	10.201	-	-
AVG	2.761	2.213	0.340	132	0.924
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VIRGINIA SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	N	N	N	N	N	N	N	N	N	N	N	N
2	O	O	O	O	O	O	O	O	O	O	O	O
3	T	T	T	T	T	T	T	T	T	T	T	T
4												
5	A	A	A	A	A	A	A	A	A	A	A	A
6	P	P	P	P	P	P	P	P	P	P	P	P
7	P	P	P	P	P	P	P	P	P	P	P	P
8	L	L	L	L	L	L	L	L	L	L	L	L
9	I	I	I	I	I	I	I	I	I	I	I	I
10	C	C	C	C	C	C	C	C	C	C	C	C
11	A	A	A	A	A	A	A	A	A	A	A	A
12	B	B	B	B	B	B	B	B	B	B	B	B
13	L	L	L	L	L	L	L	L	L	L	L	L
14	E	E	E	E	E	E	E	E	E	E	E	E
15												
16												
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21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
SUM	N.A.	-	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	-	-	N.A.
AVG	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE HEATING SUBSYSTEM

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VI   SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	1.592	100	1.592	0.702	0.000	N	0.000	-0.311	2.654	75	59
2	2.928	100	2.925	1.379	0.004	O	0.006	-0.312	4.874	75	51
3	3.515	35	1.237	1.605	4.152	T	6.919	-0.313	2.062	75	47
4	5.452	13	0.718	1.977	5.016		8.361	-0.313	1.196	73	40
5	*	*	*	*	*	A	*	*	*	*	*
6	8.192	98	8.007	2.043	0.185	P	0.309	-0.313	13.345	73	39
7	7.958	72	5.714	1.990	2.294	P	3.824	-0.313	9.523	71	37
8	5.511	77	4.253	1.962	1.290	L	2.149	-0.314	7.088	72	44
9	7.062	22	1.586	1.938	5.509	I	9.182	-0.314	2.643	72	38
10	5.999	55	3.312	1.863	2.795	C	4.658	-0.313	5.521	71	44
11	*	*	*	*	*	A	*	*	*	*	*
12	*	*	*	*	*	B	*	*	*	*	*
13	*	*	*	*	*	L	*	*	*	*	*
14	3.853	46	1.757	0.703	2.418	E	4.030	-0.315	2.928	73	49
15	3.558	100	3.558	0.703	0.000		0.000	-0.315	5.931	73	49
16	5.474	31	1.698	1.996	5.396		8.994	-0.316	2.830	74	45
17	4.247	40	1.692	1.988	2.815		4.692	-0.316	2.820	75	48
18	3.975	52	2.071	2.064	2.042		3.404	-0.313	3.452	76	51
19	3.122	100	3.122	1.409	0.000		0.000	-0.238	5.204	76	53
20	3.446	100	3.444	1.573	0.002		0.004	-0.309	5.739	77	52
21	2.802	100	2.802	1.636	0.000		0.000	-0.308	4.670	77	60
22	2.008	100	2.008	1.656	0.000		0.000	-0.308	3.347	77	64
23	0.995	100	0.994	0.811	0.004		0.006	-0.194	1.657	78	63
24	1.065	100	1.062	0.633	0.003		0.005	-0.233	1.770	78	62
25	0.484	100	0.484	0.470	0.000		0.000	-0.115	0.806	78	69
26	0.000	0	0.000	0.000	0.002		0.003	0.000	0.000	76	60
27	0.000	0	0.000	0.000	0.009		0.015	0.000	0.000	75	58
28	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	71	51
29	0.000	0	0.000	0.000	0.000		0.000	0.000	0.000	69	47
30	3.492	100	3.490	1.400	0.001		0.002	-0.219	5.817	74	56
SUM	100.077	-	66.376	37.501	39.160	N.A.	65.266	-7.283	110.627	-	-
AVG	3.336	66	2.213	1.250	1.305	N.A.	2.176	-0.243	3.688	74	51
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

4293

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SPACE COOLING SUBSYSTEM

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VIRGINIA SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MON.	SPACE COOLING LOAD MILLION BTU	SOLAR FR.OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG DRY BULB TEMP F	AMB TEMP DEG F
1	0.000	0	0.000	0.000	0.000	0.000	N	0.000	N	75	59
2	0.000	0	0.000	0.000	0.000	0.000	O	0.000	O	75	51
3	0.000	0	0.000	0.000	0.000	0.000	T	0.000	T	75	47
4	0.000	0	0.000	0.000	0.000	0.000		0.000		73	40
5	*	*	*	*	*	*	A	*	A	*	*
6	0.000	0	0.000	0.000	0.000	0.000	P	0.000	P	73	39
7	0.000	0	0.000	0.000	0.000	0.000	P	0.000	P	71	37
8	0.000	0	0.000	0.000	0.000	0.000	L	0.000	L	72	44
9	0.000	0	0.000	0.000	0.000	0.000	I	0.000	I	72	38
10	0.000	0	0.000	0.000	0.000	0.000	C	0.000	C	71	44
11	*	*	*	*	*	*	A	0.000	A	*	*
12	*	*	*	*	*	*	B	*	B	*	*
13	*	*	*	*	*	*	L	*	L	*	*
14	0.000	0	0.000	0.000	0.000	0.000	E	0.000	E	73	49
15	0.000	0	0.000	0.000	0.000	0.000		0.000		73	49
16	0.000	0	0.000	0.000	0.000	0.000		0.000		74	45
17	0.000	0	0.000	0.000	0.000	0.000		0.000		75	48
18	0.000	0	0.000	0.000	0.000	0.000		0.000		76	51
19	0.000	0	0.000	0.000	0.000	0.000		0.000		76	53
20	0.000	0	0.000	0.000	0.000	0.000		0.000		77	52
21	0.000	0	0.000	0.000	0.000	0.000		0.000		77	60
22	0.000	0	0.000	0.000	0.000	0.000		0.000		77	64
23	0.020	0	0.000	0.034	0.009	0.013		0.000		78	63
24	0.000	0	0.000	0.000	0.000	0.000		0.000		78	62
25	1.375	0	0.000	0.370	0.280	0.400		0.000		78	69
26	0.000	0	0.000	0.000	0.000	0.000		0.000		76	60
27	0.000	0	0.000	0.000	0.000	0.000		0.000		75	58
28	0.000	0	0.000	0.000	0.000	0.000		0.000		71	51
29	0.000	0	0.000	0.000	0.000	0.000		0.000		69	47
30	0.000	0	0.000	0.000	0.000	0.000		0.000		74	56
SUM	1.610	-	0.000	0.466	0.333	0.476	N.A.	0.000	N.A.	-	-
AVG	0.054	0	0.000	0.016	0.011	0.016	N.A.	0.000	N.A.	74	51
NBS	Q502	N500	Q500	Q503	Q501		Q508	Q512	Q514	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

4293

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: PAGE JACKSON SCHOOL   CHARLESTOWN, WEST VIRGINIA   SOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	805	N	59	65	N	N	N
2	267	O	51	51	O	O	O
3	215	T	47	47	T	T	T
4	44		40	41			
5	*	A	*	*	A	A	A
6	3497	P	39	40	P	P	P
7	2225	P	37	*	P	P	P
8	1206	L	44	50	L	L	L
9	125	I	38	38	I	I	I
10	2122	C	44	*	C	C	C
11	*	A	*	*	A	A	A
12	*	B	*	*	B	B	B
13	*	L	*	*	L	L	L
14	1574	E	49	55	E	E	E
15	1162		49	51			
16	284		45	48			
17	1071		48	54			
18	2365		51	60			
19	2376		53	60			
20	2138		52	61			
21	2232		60	72			
22	1229		64	71			
23	621		63	68			
24	522		62	69			
25	2028		69	77			
26	188		60	60			
27	722		58	62			
28	1456		51	67			
29	1403		47	53			
30	2156		56	68			
SUM	39267	N.A.	-	-	-	-	-
AVG	1309	N.A.	51	58	N.A.	N.A.	N.A.
NBS ID	Q001		N113			N115	N114

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
THERMODYNAMIC CONVERSION EQUIPMENT

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VISOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	EQUIPMENT LOAD MILLION BTU	THERMAL ENERGY INPUT MILLION BTU	OPERATING ENERGY MILLION BTU	ENERGY REJECTED MILLION BTU	COEFFICIENT OF PERFORMANCE (SEE NOTE)
1	0.000	0.000	0.000	N	0.000
2	0.000	0.000	0.000	O	0.000
3	0.000	0.000	0.000	T	0.000
4	0.000	0.000	0.000		0.000
5	*	*	*	A	*
6	0.000	0.000	0.000	P	0.000
7	0.000	0.000	0.000	P	0.000
8	0.000	0.000	0.000	L	0.000
9	0.000	0.000	0.000	I	0.000
10	0.000	0.000	0.000	C	0.000
11	*	*	*	A	*
12	*	*	*	B	*
13	*	*	*	L	*
14	0.000	0.000	0.000	E	0.000
15	0.000	0.000	0.000		0.000
16	0.000	0.000	0.000		0.000
17	0.000	0.000	0.000		0.000
18	0.000	0.000	0.000		0.000
19	0.000	0.000	0.000		0.000
20	0.000	0.000	0.000		0.000
21	0.000	0.000	0.000		0.000
22	0.000	0.000	0.000		0.000
23	0.000	0.000	0.000		0.000
24	0.000	0.000	0.000		0.000
25	0.000	0.000	0.000		0.000
26	0.000	0.000	0.000		0.000
27	0.000	0.000	0.000		0.000
28	0.000	0.000	0.000		0.000
29	0.000	0.000	0.000		0.000
30	0.000	0.000	0.000		0.000
SUM	0.000	0.000	0.000	*	0.000
AVG	0.000	0.000	0.000	*	0.000

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.
NOTE:

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
AUXILIARY THERMODYNAMIC CONVERSION EQUIPMENT

SITE: PAGE JACKSON SCHOOL CHARLESTOWN, WEST VISOLAR/2036-79/04
REPORT PERIOD: APRIL,1979

DAY OF MONTH	EQUIPMENT LOAD MILLION BTU	THERMAL ENERGY INPUT MILLION BTU	OPERATING ENERGY MILLION BTU	ENERGY REJECTED MILLION BTU	COEFFICIENT OF PERFORMANCE (SEE NOTE)
1	0.000	0.000	0.000	N	0.000
2	0.000	0.000	0.000	O	0.000
3	0.000	0.000	0.000	T	0.000
4	0.000	0.000	0.000		0.000
5	*	*	*	A	*
6	0.000	0.000	0.000	P	0.000
7	0.000	0.000	0.000	P	0.000
8	0.000	0.000	0.000	L	0.000
9	0.000	0.000	0.000	I	0.000
10	0.000	0.000	0.000	C	0.000
11	*	*	*	A	*
12	*	*	*	B	*
13	*	*	*	L	*
14	0.000	0.000	0.000	E	0.000
15	0.000	0.000	0.000		0.000
16	0.000	0.000	0.000		0.000
17	0.000	0.000	0.000		0.000
18	0.000	0.000	0.000		0.000
19	0.000	0.000	0.000		0.000
20	0.000	0.000	0.000		0.000
21	0.000	0.000	0.000		0.000
22	0.000	0.000	0.000		0.000
23	0.020	0.013	0.020		1.613
24	0.000	0.000	0.000		0.000
25	1.375	0.400	0.477		3.440
26	0.000	0.000	0.000		0.000
27	0.000	0.000	0.000		0.000
28	0.000	0.000	0.000		0.000
29	0.000	0.000	0.000		0.000
30	0.000	0.000	0.000		0.000
SUM	1.610	0.476	0.574	*	-
AVG	0.054	0.016	0.019	N.A.	3.384

* DENOTES UNAVAILABLE DATA.
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NOTE:

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